newleaf
new ideas in irrigation

Irrigation Discussion

What is Irrigation?

An artificial mechanism used to apply water to a soil/substrate to assist in the growing of a crop.

Other attributes linked to this mechanism:

- Crop Establishment
- Frost Protection
- Cooling
- Humidifying
- Hydrating
- Flushing, etc.

Carrier Mechanism:

- Used to apply Feeds, Fertilizers & other chemicals
- Introduction of Nematodes

Understanding & Planning

PLANNING

- Crop Types, Varieties
- Planting schedule – growth stages
- Feed requirements
  – Do they differ? How many?
- pH Correction
- Peripheral requirements
  – crop establishment (sprinklers)

BACK TO BASICS

- Understanding crop water requirements
- Understanding irrigation systems
  – product knowledge

INFORMED DECISION
(selecting an irrigation system)

- Right tool for the job
  - Know what you are buying in to
- Meet plant requirements
- Get around in good time
- Allow for expansion

Product Knowledge

Get to know the Pressure Compensating Dripper

Two variants:

- **On-line** ~ PCJs, CNLs

Pushed into LDPE Pipe

ON-LINE

- **In-line** ~ Dripline

“Welded” onto inner wall of dripline during manufacturing

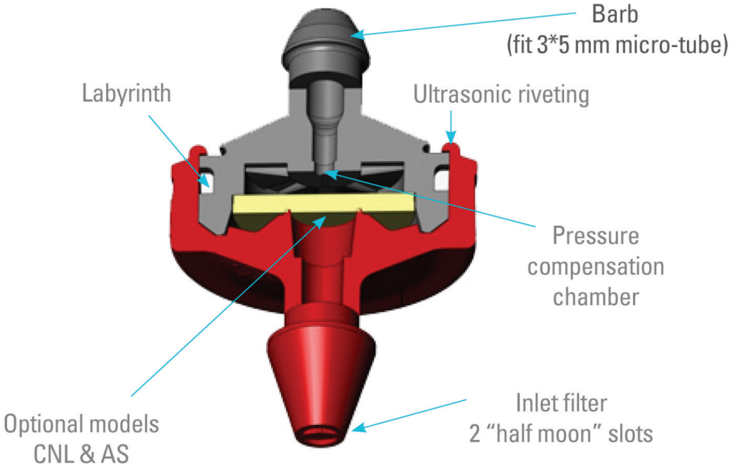
IN-LINE

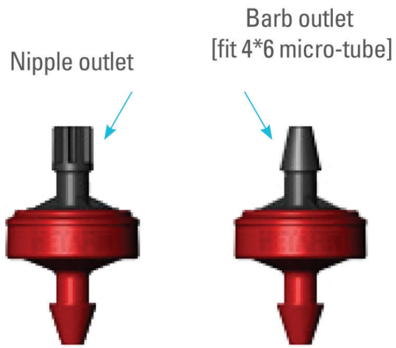
Parts of a dripper…

Common to all drippers …

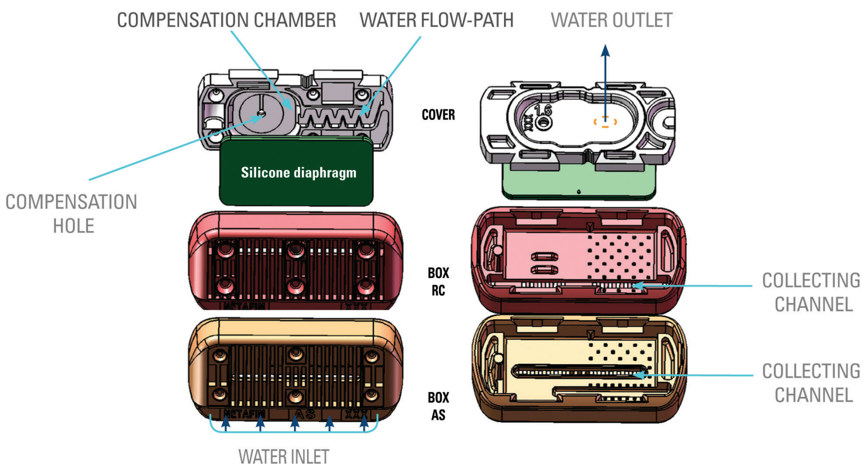
- **Base**
- **Cap**
- **Lazer Cut silicone disc**
- **Labyrinth (water passage)**

On-line Dripper Make-up

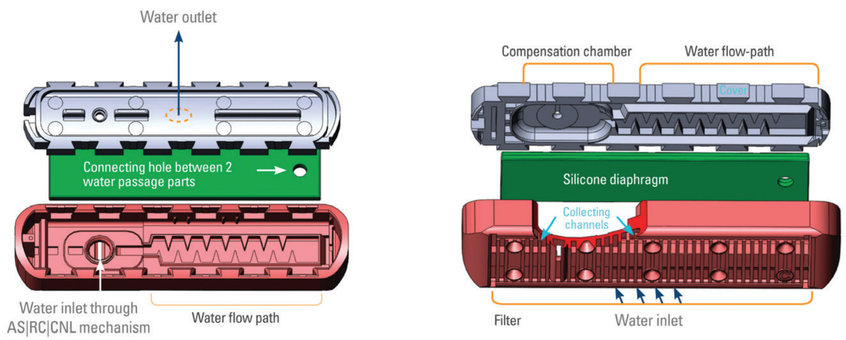




In-line Dripper Make-up (Dripnet PC)



In-line Dripper Make-up (Uniram)

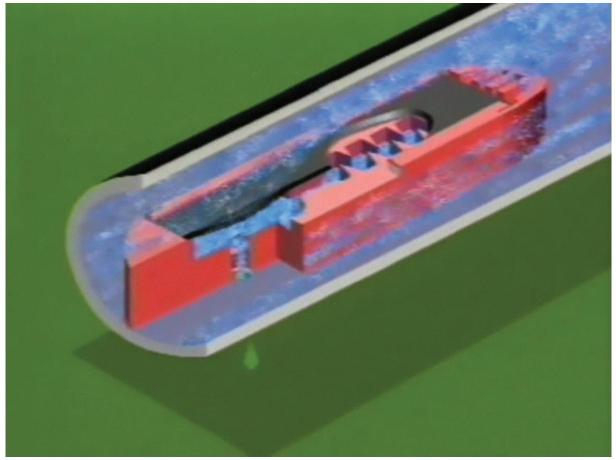


Science behind the Dripper

THE DIAPHRAGM

- Lazer Cut silicone disc
- Chemical resistant
- Means of providing Pressure Compensation & constant flow rate of the dripper
- Means of CNL (Compensated Non-Leakage) mechanism of dripper (dripper shut off)

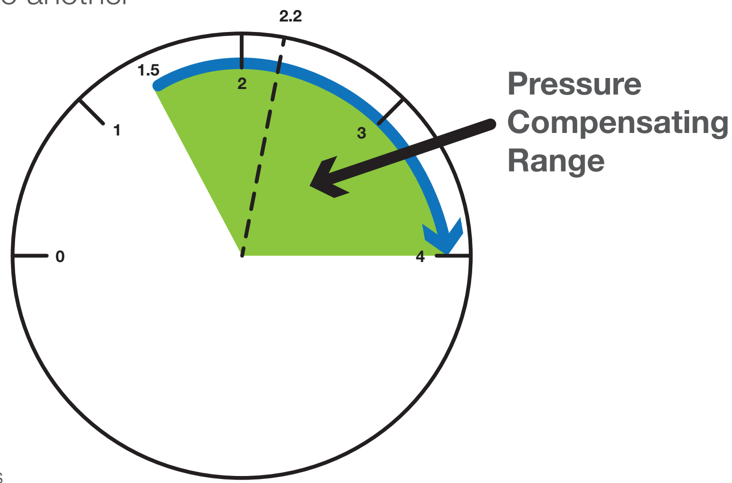
Diaphragm
Pressure Compensation



Pressure Compensating Range

Pressure compensating drippers have a pressure range in which they regulate.

- Varies from one manufacturer to the next
- Varies from one dripper model to another

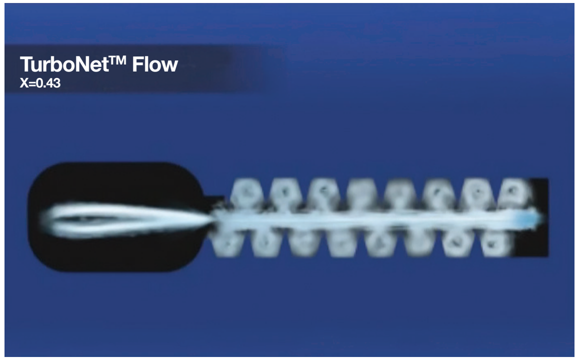


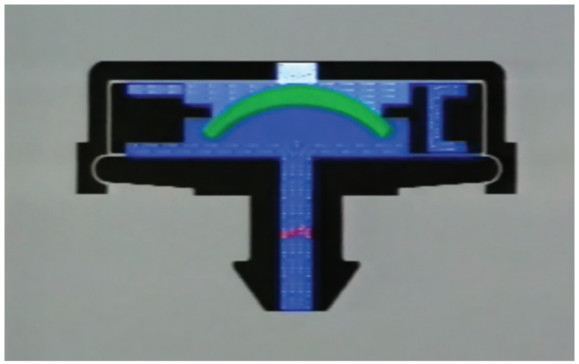
Example used: Netafim 2L/hr H-CNL PCJ Drippers

Science behind the Dripper

THE LABYRINTH (water passage)

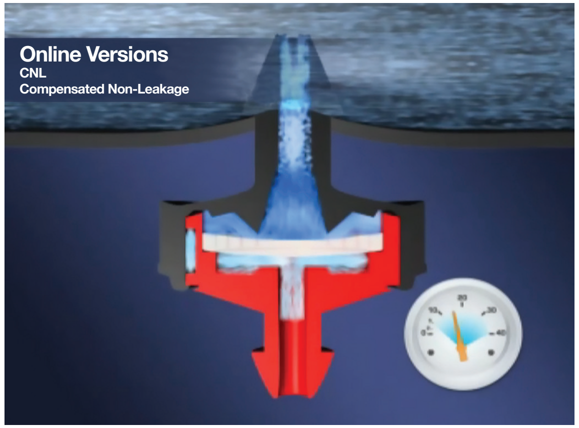
- Governs efficiency and accuracy of dripper unit
  - Provides the mechanism to produce accurate flow rate of dripper based on friction through the passage
- Means of providing a self-cleaning mechanism to the dripper
  - Designed to help break down dirt particles
  - Prevent sedimentation





Diaphragm

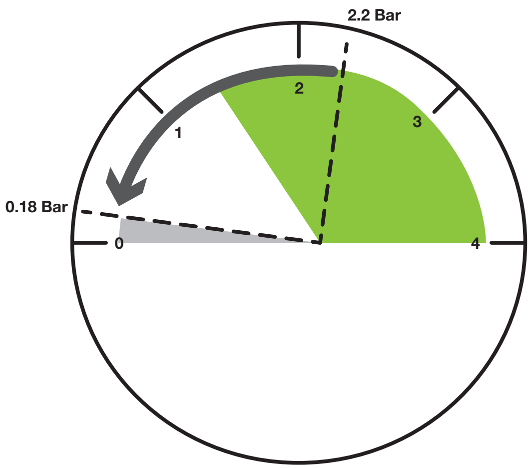
CNL Function (Shut Off)



CNL

Dripper Shut Off

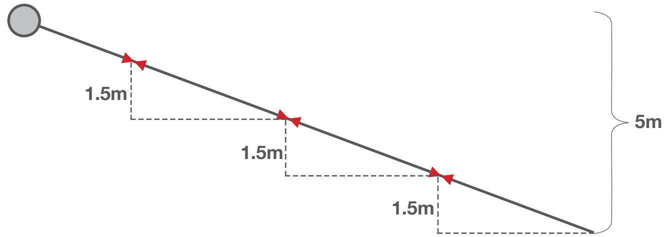
- Shut off pressure



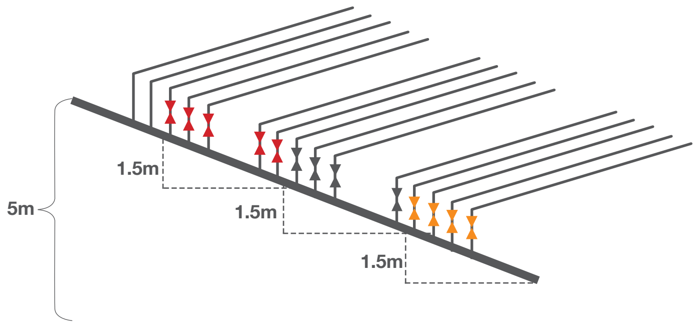
Example used: Netafim 2L/hr H-CNL PCJ Drippers

DNL vs. Pressure Shut Off

- Example:
  Dripper shut off at 1.8m (0.18Bar)



- Example:
  Dripper shut off at 1.8m



DNL Placement

AT DESIGN STAGE

- Consideration of DNLs crucial at design stage
- Hydraulic influence of DNL placement needs to be taken into consideration (pump sizing)
- Approx. quantity determined using Google Earth & Ordinance Survey Imagery

SUPPLY AND INSTALLATION

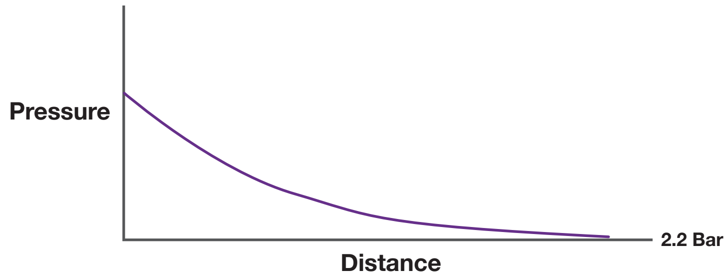
- Actual quantity required to be determined on site once pipes are in place
  - Possible last minute changes in row lengths, etc.
- NL team pinpoint DNL positions using Lazer Level
  - Done with grower or one of his farm team to ensure understanding of application.

MAINTENANCE

- Need to be disconnected or removed during winter

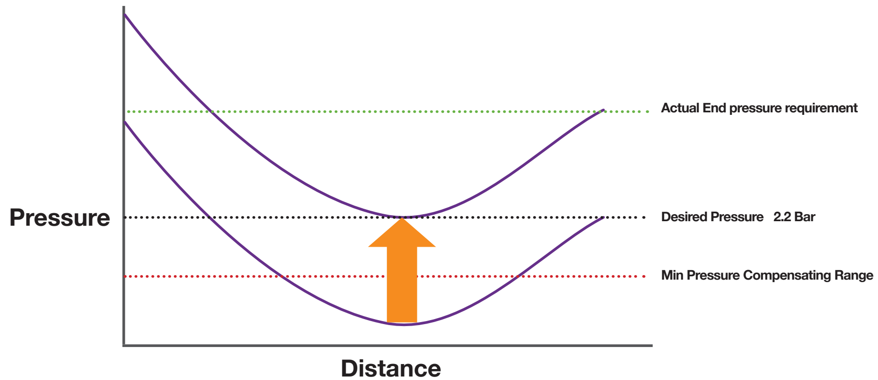
Pressure vs. slope

- Pressure drop over distance on lateral with drippers – zero slope



- Pressure drop over distance on lateral with drippers – uphill slope

- Pressure drop over distance – downhill slope



Getting the best out of a dripper

- Uniform application of water
- Uniform application of feeds, fertilisers and Nematodes
- Less Blockages

What this means to a grower

- Better use of water
- Better use/distribution of feeds, fertilisers and Nematodes
- Less disease issues from excess water/drain on fields
- Improved average yields
- Improved fruit quality
- Less man hours spent identifying and topping up “dry spots”
- Less time repairing blockages
- Overall cost saving

What this means to an Agronomist

- Confidence in knowledge that the irrigation system, utilised as a carrier on which many agronomic recommendations and decisions are being made, is applying accurately and uniformly, in order to achieve the desired end result.

Dripper Sampling Infield

A method of checking performance of drippers infield:

What we need:

- Containers – 2Ltr milk bottles are suitable. These need to be weighed and weight of EMPTY container marked on each individual container. Suggest 17 being required for test.
- String/Zip Ties for fixing of containers to table tops.
- Stop watch
- Scales – measure in grams
- Paper & Pen to record data collected
- Pressure Check Points, Pressure Gauge & Needle

Dripper Sampling

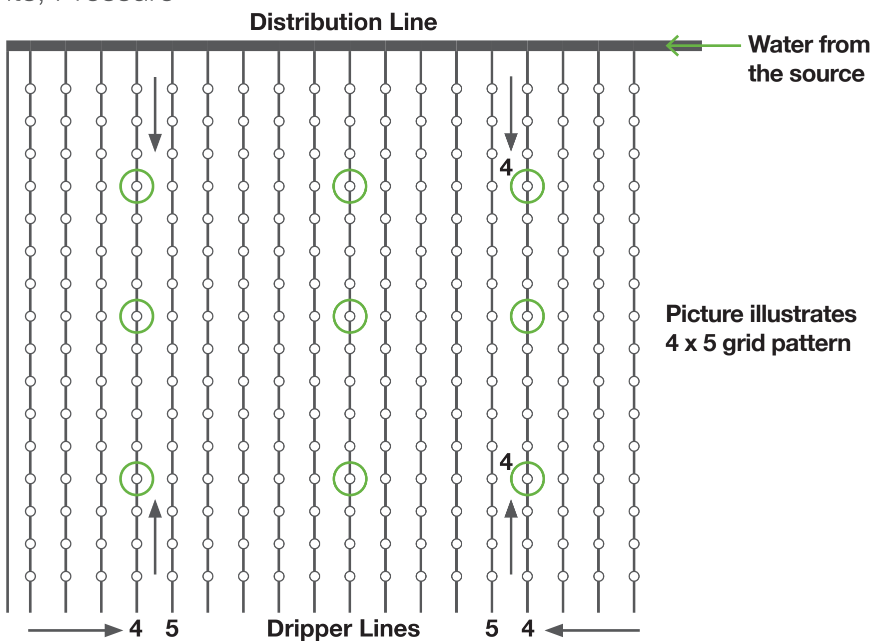
Test method is TWO fold, namely:

SYSTEM TEST

- Provides an overview of volume of water applied from start to finish of an irrigation application.
- Collects ALL water output of dripper, even that delivered as the lateral depressurises to the closing pressure of the dripper.

DRIPPER TEST (“Spot Test”)

- Provides an overview of the actual amount of water delivered by the dripper.



Dripper Sampling
The test …

DRIPPER TEST ("Spot test"):

- With system turned OFF, select a number of containers to place under dripper positions to collect output of the dripper.
- NOTE: in this test you will need a number of colleagues, each at a designated dripper collection point.
- Turn on irrigation system and run an irrigation programme.
- Whilst system is running, measure the output of drippers for 1-2 minutes only. Remove container after time allocated (even if dripper is still dripping).
- Weigh container and contents, less weight of container, and record results.

SYSTEM TEST:

- With system turned OFF, select nine (9) containers placing under dripper positions to collect output of the dripper.
- Turn on irrigation system and run a NORMAL irrigation programme.
- Make sure to record and note pressure in the driplines/laterals whilst system is running.
- On completion of irrigation programme, allow drippers to STOP dripping, collect and weigh the container and contents. Deduct weight of container and record results.

Dripper Sampling Result Examples

Results example 1…

System Test Results

	Row 1	Row 2	Row 3
Submain End	295	284	296
Middle	290	292	295
Endcap End	297	300	307
Average Flow	295		
Lowest Flow	284		
Highest Flow	307		
Flow Rate Variation	7%		

Dripper Test Results

	Row 1	Row 3
Submain End	101	96
Endcap End	97	100
Average Flow	99	
Lowest Flow	96	
Highest Flow	101	
Flow Rate Variation	5%	

Results example 2…

System Test Results

	Row 1	Row 2	Row 3
Submain End	295	287	296
Middle	307	305	313
Endcap End	380	392	375
Average Flow	382		
Lowest Flow	287		
Highest Flow	392		
Flow Rate Variation	27%		

Dripper Test Results

	Row 1	Row 3
Submain End	101	96
Endcap End	97	100
Average Flow	99	
Lowest Flow	96	
Highest Flow	101	
Flow Rate Variation	5%	

Results example 3...

System Test Results

	Row 1	Row 2	Row 3
Submain End	295	287	296
Middle	307	305	313
Endcap End	380	392	375
Average Flow	328		
Lowest Flow	287		
Highest Flow	392		
Flow Rate Variation	27%		

Dripper Test Results

	Row 1	Row 3
Submain End	101	96
Endcap End	110	109
Average Flow	104	
Lowest Flow	96	
Highest Flow	110	
Flow Rate Variation	13%	

What about the rest of the hydraulic system?

Block Sizing & number of valve sections

DEPENDANT ON HOW QUICKLY ONE WANTS TO GET AROUND

INFLUENCERS:

- Crop type – water requirements
- Stage of growth
- Pot/Bag Size
- Growing media
  - course/free draining?
  - Manufacturer
- System expansion

TYPICAL CYCLE TIMINGS:

- Raspberries - 30 minutes
- Strawberries - 45 minutes

TYPICAL VALVE RUN TIMES:

- 3 minutes

Block Sizing & number of valve sections

VALVE SECTION CONTROL:

- One valve at a time
- Too large an area – consider sub dividing and running two valves at one time

INFLUENCERS:

- Too large a block
  - Valve section takes longer to fill and get to pressure (#compensating range of dripper#).
  - Slower pressurisation suggests.
    - ~ Variable distribution of water, feeds & fertilisers.
    - ~ Excessively Wet & Dry bags
    - ~ Excess drain
- Hidden Issue
  - As season progresses, problem is "masked"
    - ~ Areas being underwatered / overwatered will remain as system is run to worst case requirement.

THESE ARE FACTORS THAT NEED TO BE DISCUSSED AND CONSIDERED WITH THE GROWER AT INITIAL PLANNING & DESIGN STAGE

Mainline Sizing

- Determined from flow requirements in section sizing.

INFLUENCERS:

- Flow
- Pipe Type - PVC or PE
- Distance
- Slope
- Velocities – speed of water travelling through pipe

MARKET HABITS:

- Under sizing pipes – working to extreme limit of velocities
  - Water Hammer – medium to long term wear on joints & fittings
  - High pressure pump
    - ~ Increased electrical consumption
    - ~ Higher long term electric costs

Filtration

- Sized to suit flow requirement of system
- Sized to suit worst case debris loading of water source

FILTER TYPE:

- Screen or Sand Filter
- Automation
  - Stand alone
  - Linked to control – Priva/Netafim
- Ensure correct pressure for flushing process
- Ensure correct flow for flushing process
- Further filtration – Secondary and Tertiary filters

MARKET HABITS:

- Under sizing filters – flow and debris loading
- No Secondary and/or Tertiary filters
- Lack of maintenance – change sand, check screen

Dosing Selection

GROWER

- May have a manufacturer preference

OTHER DETERMINING INFLUENCES

- Flows and Pressures involved
- Number of channels required
- Dosing Rates
- Range of sensors grower would like to consider
- Flexibility
- Expansion capabilities
- Costs

RIG TYPES

- Cost effective “Inline” options
  - Wrap Around (utilising system pump) – Netafim Fertikit
  - Pressurised line – Netafim Fertikit PL
  - Direct Inline – Priva Nutrijet Pumpless

  *Priva contains mixing chamber
- Higher End “Inline” options
  - Priva Nutrijet
  - Netafim Netajet

  *Both contain mixing chambers
- Cost effective “Mix Tank” options
  - Entry Level Mix Tank – Priva Nutrifit
- Higher End “Mix Tank” options
  - Priva Nutriflex
  - Netafim Netaflex

Pump Selection

CAPABLE OF DELIVERING REQUIRED SYSTEM FLOW AND PRESSURE

DETERMINING FACTORS

- System flow requirement based on section sizing
- Flow requirement of Dosing Channels on rig
- Flow requirement for filter flushing – automatic screen filters
- Pressure requirement of dripper infield
- Pressure requirement based on hydraulic calculation frictional losses through pipe and fittings
- Frictional losses through filtration system
- Slopes
- DNLs

OTHER ALLOWANCES

- Reserved amount in flow and pressure
  - Old drippers, if not changed, may deliver more flow over time.

Water Source – pH Correction

MORE NOTABLE A REQUIREMENT

- Especially where pH values from source are high and vary

GROWERS EXPERIENCE

- Injecting concentrated acids direct inline into source water as part of dosing regime
- pH value change is slow, and in some cases very small
- pH value at dripper is varied and unstable
- Acid particles work on free bicarbonates producing gaseous CO^2
- CO^2 reabsorbed into water slowing or stopping reaction inside a closed inline system

WHAT IS NEEDED:

- TIME – for chemical reaction to take place, especially in case of bicarbonate buffer being present.
- Means of VENTING TO ATMOSPHERE – bringing treated water in contact with air for longer to vent CO^2 from chemical reaction.

HOW?

- pH Correction dosing at storage tank
- Offers time for reaction to take place
- Offers a means of venting by-products to atmosphere

Maintenance timetable

When operating a new system for the first time

- Flush the piping - main line, sub-mains and distribution pipes.
- Flush the dripperlines.
- Check actual flow rate and working pressure for each irrigation shift (when the system is active for at least half an hour).
- Compare the data collected to the data supplied with the system (planned). The tolerance should not be greater than ±5%.
- Write down the newly acquired data and keep it as benchmark for future reference.
- If the flow rate and/or the working pressure at any point in the system differ by more than 5% from the data supplied with the system, have the installer check the system for faults.

Once a week

- Check actual flow rate and working pressure for each irrigation shift under regular operating conditions (i.e., when the system is active for at least half an hour and stabilized).
- Compare the data collected to the benchmark data.
- Check that the water reaches the ends of all the dripperlines.
- Check the pressure differential across the filters.

A well-planned filtration system should lose 0.2 - 0.3 bar (when the filtration system is clean).

If the pressure differential exceeds 0.8 bar (11.6 PSI), check the filter/s and their controller for faults.

Once a month

- Check the pump's flow rate and pressure at its outlet.
- Flush the dripperlines. (A higher or lower frequency may be required, depending on the type and quality of the water.)
- If the filtration system is automatic, initiate flushing of the filter/s and check that all the components work as planned.
- If pressure-regulating valves are installed, check the pressure at the outlet of each one of them and compare these figures with the benchmark data.

Once a growing season

In some cases the following need to be performed twice or three times in a growing season, depending on the type and quality of the water used.

- Check all the valves in the system.
- Check the level of dirt in the system (carbonates, algae & salt sedimentation).
- Check for occurrence of dripper clogging.
- Flush the piping - main line, sub-mains and distribution pipes.
- If necessary, inject hydrogen peroxide and/or acids as required.

At the end of the growing season

- Inject chemicals for the maintenance and flushing of the main line, the sub-main lines, the distribution pipes and the dripperlines.
- Flush the dripperlines.
- Prepare the system for the inactive period between the growing seasons.
- Perform winterization of the system in regions where the temperature might drop below 0ºC (32ºF).

Hydraulic conditions checklist

Keeping track of the system's hydraulic conditions - flow rate and pressure - is of utmost importance for the detection of malfunction, clogging and leaks in the system.

Use a hydraulic conditions checklist (in the form of a table) representing the flow rate and pressure at the head of the system and at the head of each plot.

Fill-in the table's first row* with the planned system data received from New Leaf Irrigation Ltd.

Fill-in the table's second row** with the benchmark data recorded at the time of initial operation of the system (record the data after the system's flow rate and pressure are stabilized).

The benchmark data should not deviate from the planned data by more than ±5%.

If a deviation greater than ±5% is recorded at any point in the system, call your local New Leaf Irrigation Ltd. representative.

Fill in the following rows with the actual data recorded each time the system is checked during regular operation according to the **Maintenance timetable**, (oposite).

If a deviation greater than ±5% is recorded at any point in the system, troubleshoot the problem and record the hydraulic conditions again after troubleshooting.

If, at any point in the system, hydraulic conditions within ±5% deviation of the benchmark data cannot be restored, call your local New Leaf Irrigation Ltd. representative.

The hydraulic conditions checklist should be filled in regularly and kept for future reference.

	At the pump outlet		Filter		Plot name/number:	
Date	**Flow rate** (m^3/h or l/sec)	**Pressure** (bar)	**Inlet pressure** (bar)	**Outlet pressure** (bar)	**Pressure afterthe plot valve** (bar)	**Pressure at the end of the furthest dripperline** (bar)
Planned* __ / __ / __						
Benchmark** __ / __ / __						
__ / __ / __						
__ / __ / __						
__ / __ / __						
__ / __ / __						
__ / __ / __						
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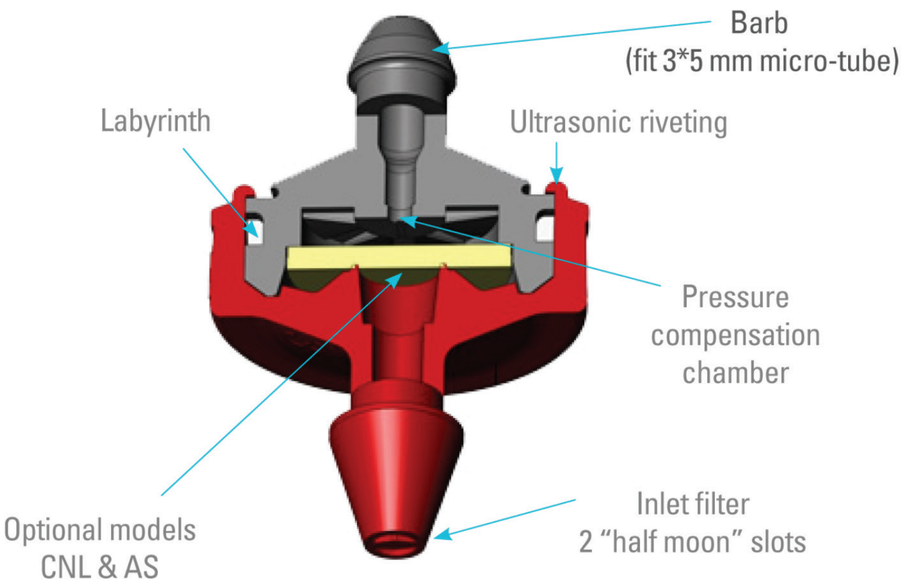
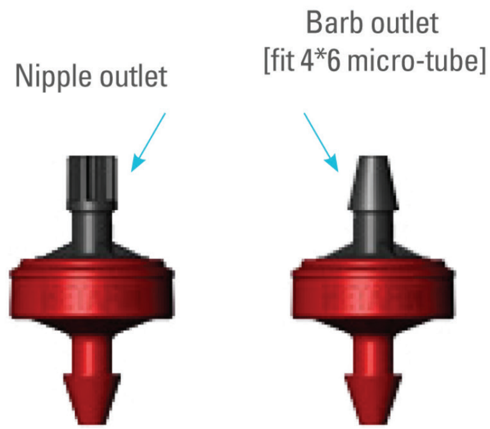
__ / __ / __						

Download the form at http://www.netafim.com /irrigation-products-technical-materials

PCJ on-line Netafim™ Dripper
Big advantages from the small details

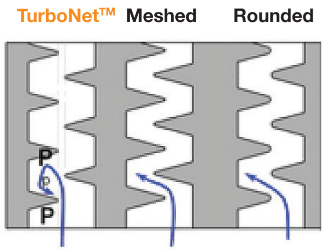
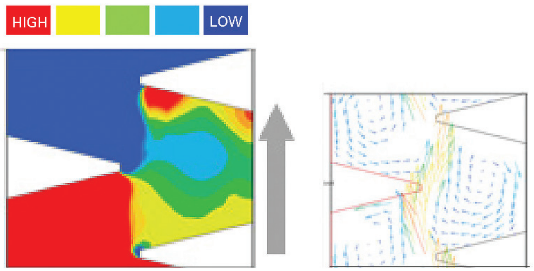
- The dripper is made of 2 plastic parts – an inlet and a labyrinth with a silicon diaphragm between them.
- The dripper has very small silhouette, and yet large flow-path due to high quality labyrinth with strong turbulence.





- Water enters the dripper through the filter's slots, and then flows via the water flow path into the compensation chamber from where it exits through the outlet.
- The PCJ has high, proven resistance to clogging even in adverse water conditions as well as very low flow rate.
- PCJ has a unique wide range of flow rates: 0.5, 1.2, 2.0, 3.0, 4.0, 8.0, 12 and 15 l/hr.
- As well high flow PCJ-Bubblers 20, 25, 30, 35 and 40 l/hr.
- Available with Anti siphon, low CNL and high CNL versions.

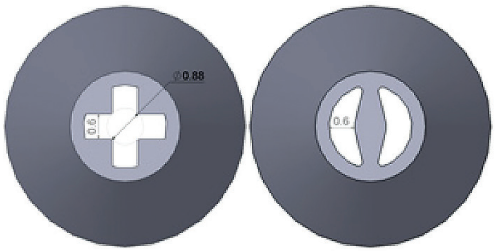
FLOW-PATH: LABYRINTH

ELEMENT	PCJ FEATURES	IMPORTANCE & BENEFITS
Built to pass relatively low flow, in a relatively large flow path. Prevents dirt accumulation inside it.	• Built from thin, sharp teeth> create flow detachment and low pressure zones (vacuum)> high drag and strong turbulence. • Despite low flow, local velocities are very high> strong turbulence prevents sedimentation that may lead to clogging. • Labyrinth is sealed by plastic cylinder with strong connection, by ultrasonic riveting > preserves teeth sharpness.	• Wide water passage. • High local turbulence prevents dirt accumulation. • Precise uniform products. • Excellent clog resistance.
	• TurboNet™ labyrinth creates flow detachment and thus creating high local velocities and strong turbulence. • Meshed or rounded teeth reduce turbulence and lead to smaller flow path and to higher sedimentation. **TurboNet™ computerized simulation** 	• Immediate pressure drop after passing the tooth. • Lowest pressure in the center of turbulence. • Arrows show direction and strength of local speed. • Local speed is ~10 times higher than average.

FILTER

ELEMENT	PCJ FEATURES	IMPORTANCE & BENEFITS
Prevents penetration of coarse particles inside the flow path, does not gets blocked, thus preventing flow path from becoming the dripper's "bottle-neck".	• Flow in distribution pipe continually washes the filters. • Slot width is smaller than dripper's flow path minimal dimension. • Unlike most on-line drippers with inlets shaped as a cross, thus letting in larger particles through its centers.	• Prevents dirt particles from plugging the flow path.

Cross filter:
slots width 0.6mm
∅0.88mm particles can go through!



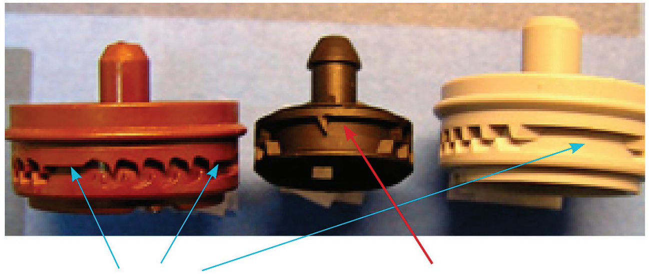
Slots filter:
slots width 0.6mm
∅0.6mm particles can go through!

FILTER COMPARISON

In most of the online drippers the inlet filter is made with "cross" shape. PCJ has a slot filter ("half moon").
The total filtration area is equal to other drippers, but the size of particles that can penetrate inside is different. The PCJ slot filter protects the flow-path much better.

SEDIMENTATION ZONES

ELEMENT	PCJ FEATURES	IMPORTANCE & BENEFITS
Zones between dripper parts where dirt settles resulting from low laminar flow.	• Minimum, short sedimentation zones prevent dirt accumulation. • The necessary connection between the two sections of the labyrinth contains an extra sharp tooth to preserve the turbulence.	• Minimal sedimentation amounts. • Excellent clog resistance.



Laminar sedimentation zones between labyrinth sections

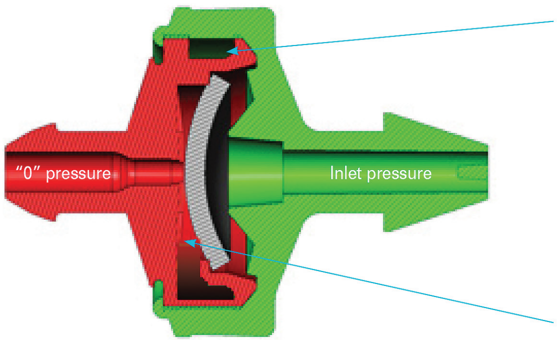
PCJ with special sharp tooth that recreates turbulence

PCJ has smaller sedimentation zones, due to the very compact size of the dripper. The flow- path dimensions are larger than other drippers, due to the labyrinth quality.

The laminar flow path between the labyrinth sections is shorter in PCJ and includes a special extra sharp tooth to preserve turbulence.

COMPENSATION CHAMBER

ELEMENT	PCJ FEATURES	IMPORTANCE & BENEFITS
Keeps a constant pressure differential upon the labyrinth, regardless of the inlet pressure, thus keeping a constant flow-rate.	• Deep chamber> efficient self-cleaning at the whole range of inlet pressures. • Preserves constant low pressure differential upon the labyrinth.	• Low pressure compensation leads to energy saving. • Wide range of pressure range allows laterals and big operations. • Compensation chamber size allows long term uniformity and accuracy.



- The diaphragm is arching according to pressure differential between both sides.
- The labyrinth breaks 0.4 bar, the minimum pressure needed for correct dripper action.
- In case of full or partial clogging, flow is reduced, the labyrinth breaks less pressure and the diaphragm deflects less opening a larger flow path to the compensation aperture for the dirt to be flushed out.

This is a continuous Self -flushing mechanism.

Notes:

Notes:

Notes:

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